

CLAIMS

1. A substrate cutting system, comprising:

a mounting base having a substrate supporting device for supporting a substrate;

clamp devices for holding at least one part of a side edge of the substrate carried-in on the table, the clamp devices reciprocating the substrate along the Y direction, the Y direction being along one side of the mounting base;

a pair of substrate cutting devices for cutting both sides of the substrate, respectively; and

substrate cutting device guide bodies, fixed to the mounting base facing each other, for moving each of the substrate cutting devices on a top surface side and a bottom surface side of the substrate in the X direction perpendicular to the Y direction, the substrate being moved in the Y direction by the clamp devices,

wherein

the substrate supporting device further includes first substrate supporting units and second substrate supporting units, the first substrate supporting units and the second substrate supporting units are apart from each other in the Y direction and arranged with the substrate cutting devices therebetween, and

the first substrate supporting units and the second substrate supporting units support the substrate such that the substrate which has been moved in the Y direction by the clamp devices is cut along the X direction and the Y direction by the substrate cutting devices.

2. A substrate cutting system according to claim 1, wherein the first substrate supporting units and the second substrate supporting units support the substrate

without rubbing against the substrate when the clamp devices moves while holding the substrate.

3. A substrate cutting system according to claim 2, wherein the first substrate supporting units and the second substrate supporting units are structured by conveyor belts, respectively, the conveyor belts being rotary-driven in the moving direction of the clamp devices at the same speed as that when the clamp devices move while holding the substrate.

4. A substrate cutting system according to claim 1, wherein the substrate cutting devices include a cutter wheel for forming a scribing line on the substrate; and a cutter head having a servo motor for transmitting a pressure force against the substrate to the cutter wheel.

5. A substrate cutting system according to claim 1, further comprising:
a steam unit section for spraying steam onto the top surface and the bottom surface of the substrate, on both of which the scribing line is scribed.

6. A substrate cutting system according to claim 5, wherein a substrate drying means is provided in the steam unit section, the substrate drying means for drying the top surface and the bottom surface of the substrate.

7. A substrate cutting system according to claim 5, further comprising a substrate carry-out device for retrieving the substrate cut by the steam unit section.

8. A substrate cutting system according to claim 7, wherein the substrate carry-out device includes a carry-out robot,

the carry-out robot includes:

a substrate holding means for holding the substrate;

a substrate rotating means for rotating the substrate holding means having the substrate held thereby about a first axis vertical to the substrate; and

a substrate circling means for circling the substrate rotating means around a second axis, the second axis being different from the first axis vertical to the substrate held by the substrate holding means.

9. A substrate cutting system according to claim 7, further comprising a substrate inversion means for inverting the top surface and the bottom surface of the substrate transported by the substrate transportation device.

10. A substrate cutting system according to claim 1, further comprising a positioning unit section for positioning the substrate to be transported to the substrate supporting device.

11. A substrate cutting system according to claim 6, further comprising a transportation unit for transporting the substrate to the substrate drying means, the substrate having been scribed by the substrate cutting device.

12. A substrate cutting system according to claim 1, further comprising a removal means for removing an unnecessary portion of the substrate cut by the substrate cutting devices.

13. A substrate cutting system according to claim 1, wherein the substrate is a bonded mother substrate for which a pair of mother substrates are bonded to each other.

14. A substrate cutting system, comprising:

a mounting base having a substrate supporting device for supporting a substrate;

clamp devices for holding at least one part of a side edge of the substrate carried-in on the table and reciprocating the substrate along the Y direction, the Y direction being along one side of the mounting base;

a pair of substrate cutting devices for cutting both side of the substrate, respectively; and

substrate cutting device guide bodies, fixed to the mounting base facing each other, for moving each of the substrate cutting devices on a top surface side and a bottom surface side of the substrate in the X direction perpendicular to the Y direction, the substrate being moved in the Y direction by the clamp devices, wherein

the substrate supporting device further includes first substrate supporting units and second substrate supporting units, the first substrate supporting units and the second substrate supporting units are apart from each other in the Y direction and arranged with the substrate cutting devices therebetween, and

the substrate cutting system further comprising

substrate floating units for supporting the substrate with air, the substrate being clamped by the clamp devices when the substrate which has been

moved by the clamp devices in the Y direction is cut by the substrate cutting devices along the X direction and the Y direction.

15. A substrate cutting system according to claim 14, wherein the substrate floating units include first substrate floating units arranged within the first substrate supporting section and second substrate floating units arranged within the second substrate supporting section.

16. A substrate cutting system according to claim 15, wherein the first substrate supporting units and the second substrate supporting units include a plurality of conveyor belts arranged along the Y direction, respectively, and the first substrate floating units and the second substrate floating units are arranged between the conveyor belts adjacent to each other.

17. A substrate cutting system according to claim 16, wherein the first substrate floating units and the second substrate floating units respectively include a table arranged between the conveyor belts adjacent to each other; and an air gushing means for gushing air upward from the top surface of the table.

18. A substrate cutting system according to claim 17, wherein the air gushing means includes a plurality of air gushing rods supported by the table in a vertical state; and a buffer pad provided at the upper end of each of the air gushing rods wherein

an air gushing opening is provided at each buffer pad.

19. A substrate manufacturing apparatus, comprising:
a substrate cutting system according to claim 1; and
a chamfering system for chamfering an edge face of a substrate cut by the substrate cutting system.
20. A substrate manufacturing apparatus, comprising:
a substrate cutting system according to claim 1; and
an inspection system for inspecting the function of a substrate cut by the substrate cutting system.
21. A scribing method for forming scribing lines on the top surface and the bottom surface of a substrate by using a substrate cutting system according to claim 1, wherein
when at least two scribing lines are formed along at least two lines to be scribed on the substrate with scribing line forming means facing each other, the scribing line forming means forms a first scribing line, then moves on the substrate so as to draw a circular region without being apart from the substrate and then forms a second scribing line.
22. A scribing method according to claim 21, wherein three or more scribing lines are formed by the scribing line forming means and a polygonal region is formed by all the formed scribing lines.
23. A scribing method according to claim 22, wherein a rectangular region is formed by the scribing lines.

24. A scribing method according to claim 21, wherein the scribing line forming means is a disk-shaped cutter wheel, a blade edge contacting and rolling on the surface of the substrate being formed on the outer circumference of the scribing line forming means.

25. A scribing method according to claim 24, wherein a plurality of protrusions is formed on the blade edge of the cutter wheel with a predetermined pitch.

26. A scribing method according to claim 21, wherein when the scribing line forming means moves on the substrate so as to draw a circular track, a pressure against the substrate is less than a pressure against the substrate when each scribing line is formed.

27. A substrate cutting method comprising the steps of:
forming a main scribing line along a line to be cut on the upper surface and the lower surface of a substrate by using a substrate cutting system according to claim 1; and

forming a supplementary scribing line proximal to the formed main scribing line and approximately in parallel with the main scribing line, wherein

the substrate is cut along the main scribing line by formation of the supplementary scribing line.

28. A substrate cutting method according to claim 27, wherein the supplementary scribing line is formed with a space of 0.5 mm to 1.0 mm apart from the main scribing line.

29. A substrate cutting method according to claim 27, wherein the main scribing line is formed by a vertical crack which extends to at least 80% or more of the thickness direction of the substrate from a surface of the substrate.

30. A substrate cutting method according to claim 27, wherein the main scribing line is formed by a disk-shaped cutter wheel which rolls on the surface of the substrate, the cutter wheel protrudes outward such that the central portion of the outer circumferential face of the cutter wheel in the thickness direction has an obtuse V shape, a plurality of protrusions with a predetermined height is provided across the entire circumference with a predetermined pitch in portions having the obtuse angle.

31. A substrate cutting method according to claim 30, wherein a forming direction of the main scribing line and a forming direction of the supplementary scribing line by the cutter wheel are opposite to each other, and the cutter wheel continuously forms the main scribing line and the supplementary scribing line while being in contact with the surface of the substrate.

32. A substrate cutting method according to claim 27, wherein the main scribing line and/or the supplementary scribing line is formed with an appropriate space apart from at least one end portion of either of the lines.

33. A substrate scribing method according to claim 27, wherein, when at least two main scribing lines are formed by the scribing line forming means, the scribing line forming means forms a first main scribing line, then moves on the substrate so as to draw a circular region without being apart from the substrate, forms a second main scribing line and then forms supplementary scribing lines along the at least two main scribing lines.

34. A scribing method according to claim 33, wherein three or more main scribing lines are formed by the scribing line forming means and a polygonal region is formed by all the formed scribing lines.

35. A scribing method according to claim 34, wherein a rectangular region is formed by the plurality of main scribing lines.

36. A scribing method according to claim 33, wherein the scribing line forming means is a disk-shaped cutter wheel, a blade edge contacting and rolling on the surface of the substrate being formed on the outer circumference of the scribing line forming means.

37. A scribing method according to claim 36, wherein a plurality of protrusions is formed on the blade edge of the cutter wheel with a predetermined pitch.

38. A scribing method according to claim 33, wherein when the scribing line forming means moves on the substrate so as to draw a circular track, a pressure

against the substrate is less than a pressure against the substrate when each main scribing line is formed.

39. A substrate cutting method for cutting a substrate in which a scribing line is formed on each of the upper surface and the lower surface of the substrate by using a substrate cutting system according to claim 1, wherein

steam is sprayed onto the upper surface and the lower surface of the substrate so as to cut the substrate.